
Chapter 13

Project Risk Analyses

Project Risk Management

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1. **SLIDE 1: CEMENT SEMINAR 2000**



Cement Seminar 2000

Project Risk Management

D. Bach Business Risk Management
H. Würmli "Holderbank" Engineering Switzerland

2. **SLIDE 2: PROJECT RISK MANAGEMENT**



Objectives:

- **Be aware of the variety of risks in CAPEX projects**
- **Take home the understanding of how to do risk management for small CAPEX projects**



3. **SLIDE 3: BUSINESS RISK MANAGEMENT**

**Business Risk Management -
"Holderbank" Vision**

Business Risk Management is a continuous process, and an element of Corporate Governance. It promotes efficient and effective assessment of risk, increases risk awareness and improves the management of risk throughout the Group. This includes anticipating and avoiding threats and losses as well as identifying and realising opportunities.

HBRM/DBB-Projekt/2000/05/12/03a **"HOLDBANK"**

4. SLIDE 4: BUSINESS RISK MANAGEMENT

**Business Risk Management
at "Holderbank"**

Target Areas:

- ⇒ Group Companies:
 - Cement
 - Aggregates
 - Concrete
 - Waste
 -

- ⇒ Financial Holdings
- ⇒ HMC
- ⇒ "Holderbank" Group
- ⇒ **Projects (incl. CAPEX Projects)**



5. **SLIDE 5: CASE**



Kiln Shell Replacement in a Lime Plant

Scope: To remove two approximate three meter lengths of kiln shell and replace with one six meter length of second hand kiln shell on site, and realign the kiln to remove the "wobble" at the front of the kiln.

- The project shall be executed during an extended kiln shut-down.
- Clients shall not be affected by this project in a manner unacceptable to them.



6. SLIDE 6: CASE

Case

What are the risks related to this project ??

Project: Stages

- Pre-shutdown activities
- Preparation of used kiln section
- Cutting, removing and shifting of kiln sections
- Replacing, aligning, and welding of kiln shell
- Kiln bricking
- Recommissioning, kiln light-up

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7. **SLIDE 7: RISK MODEL FOR CAPEX PROJECTS**

**Risk Model for CAPEX Projects
(comprehensive, Draft)**

1. External Context

- | | | |
|----------------------------|--------------------------------------|-----------------------------|
| 1.1 Industry/Market | 1.2 External Stakeholders | 1.3 Laws/Regulations |
| 1.1.1 Competitors Actions | 1.2.1 Shareholder Relations | 1.3.1 Compliance |
| 1.1.2 Economic Influences | | 1.3.2 Permitting |
| 1.1.3 Currency Risk | 1.2.2 Governmental/Public Influences | 1.3.3 Future Regulations |
| 1.1.4 Interest Rate Risk | 1.2.3 Reputation | |

2. Internal Context and Project Concept

- | | | | |
|--------------------------------------------------------|---------------------------------------------------|---------------------------------------|------------------------------|
| 2.1 Strategic Planning | 2.2 Technology, Operation | 2.3 Human Resources | 2.4 Project Economics |
| 2.1.1 Integration of Project in Company Plans | 2.2.1 Resources Availability | 2.3.1 Personnel Skills and Management | 2.4.1 Investment Cost |
| 2.1.2 Market | 2.2.2 Process & Product Quality | | 2.4.2 Operating Cost |
| 2.1.3 Contracts Related to Operation of New Facilities | 2.2.3 Operational Concept | | |
| | 2.2.4 Plant Design and Mech./El./Civ. Engineering | | |
| | 2.2.5 Logistics (outbound) | | |
| | 2.2.6 Infrastructure | | |
| | 2.2.7 Outsourcing | | |
| | 2.2.8 Environmental | | |

3. Project Realization

- | | | | |
|-------------------------------------------|-------------------------------------------------------|------------------------------------|-------------------------------------------------------|
| 3.1 Organization | 3.2 Performance of Project Management Function | 3.3 Financing and Insurance | 3.4 Performance of Contractors |
| 3.1.1 Project Parties | 3.2.1 Procurement | 3.3.1 Financing | 3.4.1 Mechanical Supplies and Erection |
| 3.1.2 Contracting Approach | 3.2.2 Contracts for Project Realization | 3.3.2 Insurance | 3.4.2 Electrical Supplies and Installation |
| 3.1.3 Project Organization | | | 3.4.3 Civil Construction (concrete, structural steel) |
| 3.1.4 Co-ordination with Production/Sales | 3.2.3 Time and Cost | | 3.4.4 Other Contracts |
| 3.1.5 Project Risk Management | 3.2.4 Quality of Plant and Equipment | | |
| | 3.2.5 Commissioning | | |
| | 3.2.6 Health & Safety | | |

8. **SLIDE 8: RISK MODELS – DEFINITION OF RISKS**

Risk Models: Definition of Risks (Draft)

- 1. External Context**
 - 1.1 Industry / Market**
 - 1.1.1 **Competitor Actions:** The risk that project success can be prevented by competitors.
 - 1.1.2 **Economic Influences:** The risk of significant changes in the size of the (potential) market for the project's product.
 - 1.1.3 **Currency Risk:** The risk of project related exposure to fluctuations in the exchange rate.
 - 1.1.4 **Interest Rate Risk:** The risk of project related exposure to interest rate fluctuations.
 - 1.2 External Stakeholders**
 - 1.2.1 **Shareholder Relations:** The risk that shareholders disagree with or block the project.
 - 1.2.2 **Governmental/ Public Inft.:** The risk that views or behaviors by the government / public authorities or the public, or any other organization will create barriers to the project.
 - 1.2.3 **Reputation:** The risk that the project does damage to the respect in which the company is held by its internal and external stakeholders resulting in loss of sales, fines & penalties, reduced government cooperation, lost business opportunities and lower share price.
 - 1.3 Laws / Regulations**
 - 1.3.1 **Compliance:** The risk that the project is not in compliance with existing laws and regulations or that compliance would imply significant additional cost.
 - 1.3.2 **Permitting:** The risk that missing permits inhibit construction, commissioning or operation, or that conditions attached to permits make the project unfeasible, or that permits issued are revoked.
 - 1.3.3 **Future Regulations:** The risk that changes in regulations by international, national and local regulators significantly affect the project.
- 2. Project Assumptions and Concept**
 - 2.1 Strategic Planning**
 - 2.1.1 **Integration of Project in Company Plans:** The risk that the project does not efficiently and effectively contribute to achieving company targets because it is not integrated in strategy and Business Plan.
 - 2.1.2 **Market:** The risk that market assumptions prove wrong or that marketing strategy fails to succeed. (This risk includes the risks "Capacity", "Service/Product Quality", and "Selling/Pricing" from the generic business risk model for cement)
 - 2.1.3 **Contracts related to Operation of new Facilities** (contracts other than supply and service contracts for project implementation; e.g. JV agreements etc.): The risk that contracts are not in compliance with legislation, with other obligations of the company, the real purpose of the management, and do not reflect the intention of the parties.
 - 2.2 Technology**
 - 2.2.1 **Resources Availability:** The risk that resources are not available at required quality and economic cost.
 - 2.2.2 **Process & Product Quality:** The risk that process selected (flowsheet) is not fit for its purpose, not cost efficient with regard to investment and operation, not delivering product quality required, not suitable for the local environment, or does not exploit potential synergies with other company internal or external facilities and operations.
 - 2.2.3 **Operational Concept:** The risk that the operational concept is not cost efficient with regard to investment and operation, not suitable for the local environment, or does not exploit potential synergies with other company internal or external facilities and operations.
 - 2.2.4 **Plant Design, Mech./El./Civil Engineering:** The risk that plant design and mech./el./civil engineering is not fit for its purpose, not cost efficient with regard to investment and operation, not suitable for the local environment, or does not exploit potential synergies with other company internal or external facilities and operations.
 - 2.2.5 **Logistics:** The risk that material flows to the new facilities and between the new facilities and other facilities and to the customers are not planned in a cost efficient and reliable manner.
 - 2.2.6 **Infrastructure:** The risk that infrastructure outside company's facilities does not fulfill operational requirements.

9. SLIDE 9: RISK MODELS – DEFINITIONS OF RISKS

Risk Models: Definition of Risks (Draft)

- 2.2.7 **Outsourcing:** The risk that foreseen split between in-house and outsourced resources is not optimum or that this split is difficult to correct later on.
- 2.2.8 **Environmental:** The risk that the project does not comply with the company's own stated environmental policy and / or with public expectations.
- 2.3 **Human Resources**
- 2.3.1 **Personnel Skills and Management:** The risk that new facilities will not be operated successfully due to HR reasons.
- 2.4 **Economic Analysis**
- 2.4.1 **Investment Cost:** The risk that investment cost exceed estimates and budgets resp.
- 2.4.2 **Operating Cost:** The risk that operating cost exceed estimates.

- 3. **Project Realization**
- 3.1 **Organization**
- 3.1.1 **Project Parties:** The risk that parties involved in a project (company, contractors, consultants, authorities, financial institutions etc.) are not able to carry out the responsibilities assigned to them or taken over by them.
- 3.1.2 **Contracting Approach:** The risk that the contracting approach does not adequately consider project environment, project characteristics and the requirements and capabilities of the company.
- 3.1.3 **Project Organization:** The risk that overall project organization as well as project organizations of parties involved in the project are not adequate to carry out the responsibilities assigned to them.
- 3.1.4 **Co-ordination with Production/Sales:** The risk that project execution seriously affects the company's medium-/long-term position in the market.
- 3.1.5 **Project Risk Management:** The risk that (key) risks materialize due to missing or ineffective Project Risk Management procedures.
- 3.2 **Performance of Project Management Function**
- 3.2.1 **Procurement:** The risk that the procurement procedure (from call for tenders to final negotiations and conclusion of contracts) does not lead to optimum cost - benefit conditions of contracts related to equipment supplies and construction/erection.
- 3.2.2 **Contracts related to Equipment Supplies and Construction/Erection:** That risk that supply and service contracts suffer major legal, commercial or other deficiencies.
- 3.2.3 **Time and Cost:** The risk that time schedules and cost estimates are not maintained due to missing or ineffective control functions, deficiencies in contracts or "scope creep" during project execution, or due to external influences such as natural disasters, strikes etc.
- 3.2.4.1 **Quality of Plant and Equip.:** The risk that target quality levels are not achieved due to insuff. contractual specification and inadequate control in workshops and on site.
- 3.2.5 **Commissioning:** The risk that commissioning is not completed within commissioning period foreseen.
- 3.2.6 **Health & Safety:** The risk that health hazards, injuries, illnesses, or fatalities occur during project execution.
- 3.3 **Financing and Insurance**
- 3.3.1 **Financing:** The risk that the project cannot be financed at feasible conditions, that the set-up of the financing is delaying the project execution, or that that restrictive conditions (e.g. contractors selection) are imposed.
- 3.3.2 **Insurance:** The risk that project implementation is not adequately protected by insurances.
- 3.4 **Performance of Contractors**
- 3.4.1 **Mechanical Supplies & Erection:** *Identical definition for all "Performance of Contractors" Risks:*
- 3.4.2 **Electrical Supplies & Installation:** The risk that contractors do not perform in accordance with their contracts and thereby jeopardize project success (time, quality, cost).
- 3.4.3 **Civil Construction (concrete, structural steel):**
- 3.4.4 **Other Contracts:**

10. SLIDE 10: PROJECT CATEGORIES AND RISK MODELS

Project Categories and Risk Models

"BIG"	> 15 mio. USD	
	- Heavily affecting long-term perspective of company	
	- Potentially all risks	Comprehensive Risk Model
"MEDIUM"	< 15 mio. USD	
	- Strategic	
	- Scenarios; co-ordination with Business Plan = iterative process	Risk Model for medium projects
	- Risks of company internal context and technical concept relevant	
"SMALL"	< 0.5 mio. USD	
	- No or little freedom regarding technical solution	Risk Model for small projects
	- Typically major repair and replacement works	
	- Mainly risks of project execution	

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11. **SLIDE 11: RISK MODEL FOR CAPEX PROJECTS**

**Risk Model for CAPEX Projects
(small projects, Draft)**

(derived from comprehensive model for big projects)

1.3 Laws/Regulations

- 1.3.1 Compliance**
- 1.3.2 Permitting**

3.1 Organization

- 3.1.1 Project Parties**
- 3.1.2 Project Organization**
- 3.1.3 Coordination with Production/Sales**

3.2 Performance of Project Management Function

- 3.2.1 Contracts for Project Realization**
- 3.2.2 Time and Cost**
- 3.2.3 Quality of Plant and Equipment**
- 3.2.4 Commissioning**
- 3.2.5 Health & Safety**

3.4 Performance of Contractors

- 3.4.1 Mechanical Supplies and Erection**
- 3.4.2 Electrical Supplies and Installation**

12. **SLIDE 12: WHY RISK MANAGEMENT IN PROJECTS**



Why Risk Management in Projects?

Murphy's Law:

Anything that **can** go wrong **will** go wrong.



13. **SLIDE 13: WHY RISK MANAGEMENT IN PROJECTS**

Why Risk Management in Projects?

Why does Murphy's Law not always prove right in projects?

➔ Project Management

Good project management considers risks and takes measures to control and manage these risks.

14. SLIDE 14: WHY RISK MANAGEMENT IN PROJECTS

Why Risk Management in Projects?

Why does Murphy's Law often prove right in projects?

- ⇒ No risk awareness
- ⇒ Work overload of people
- ⇒ Project teams not familiar with (standard) project procedures
- ⇒ Project scope and objectives unclear
- ⇒ Inadequate project organization



15. SLIDE 15: WHY RISK MANAGEMENT IN PROJECTS



Why Risk Management in Projects?

The answer:

Business Risk Management for Projects (BRMP)

BRMP for Project Management

- ~ Safety rope for mountain climbing
- ~ Safety net for high-wire walk

16. SLIDE 16: WHY RISK MANAGEMENT IN PROJECTS

Why Risk Management in Projects?

What is BRMP ?

⇒ **Standard process plus checklists**

⇒ **Objectives:**

- Risk awareness, anticipation of problems of all kind
- Alignment of views on risk profile and actions to be taken to manage risks
- Comprehensive and systematic coping with project risks



17. SLIDE 17: BRMP FOR SMALL PROJECTS

**BRMP for Small Projects
Case**

- **Workshop before project execution**
(+ follow-up by Project Manager)
- **Participants:** - Maintenance Co-ordinator (Project Manager)
 - Production Technical Manager
 - Purchasing/Stores Co-ordinator
 - Production Co-ordinator
 - Quality & Safety Advisor
 - Process Chemist
 - Site Manager
 - Company Risk Management Co-ordinator

18. SLIDE 18: BRMP FOR SMALL PROJECTS

**BRMP for Small Projects
Case**

• **Steps of Workshop:**

- Agreement on project scope and objectives
- Risk Identification
- Analysis of origin of risks (risk drivers)
- Assessment of significance and likelihood
- Assessment of risk treatment (existing / **additional**)
- Definition of responsibilities and target dates

• **Deliverables of Workshop:**

- Risk assessment + action list
(= minutes of workshop)



19. SLIDE 19: BRMP FOR SMALL PROJECTS

**BRMP for Small Projects
Forms and Checklists**

Checklist BRMP Workshop

- Preparatory Activities
- Agenda of Workshop
- Follow-up

Checklist Generic Risks and Risk Drivers

- Risk Definitions
- Generic Risk Drivers

Checklist Participants to Workshop

- Mandatory
- Project Specific

20. SLIDE 20: BRMP FOR SMALL PROJECTS

**BRMP for Small Projects
Forms and Checklists**

Form A - Risk Identification

- **Parts of Project**
- **Generic Risks**

Form B - Risk Evaluation and Management

- **Existing Risk Treatment**
- **Risk Relevance**
- **Proposed Risk Treatment**
- **Responsible Person**
- **Target Date**

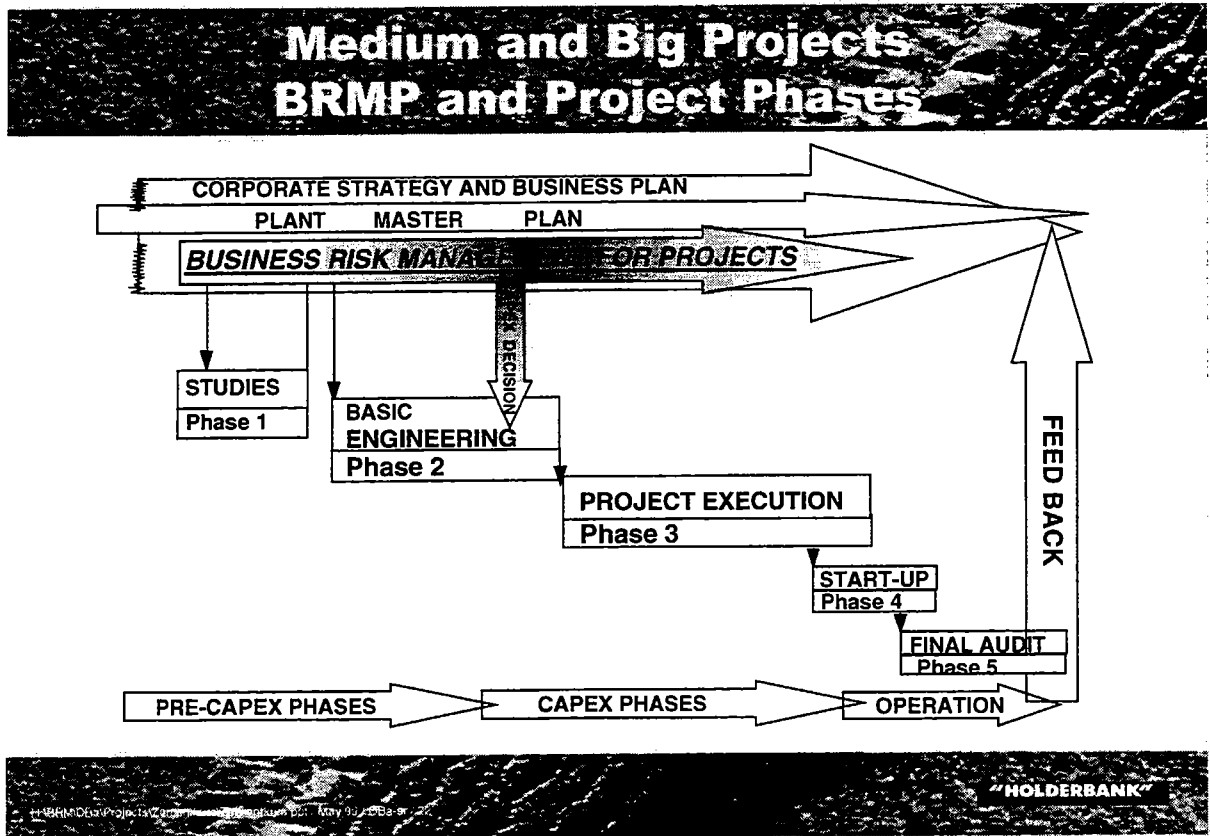


21. **SLIDE 21: BRMP FOR MEDIUM AND BIG PROJECTS**

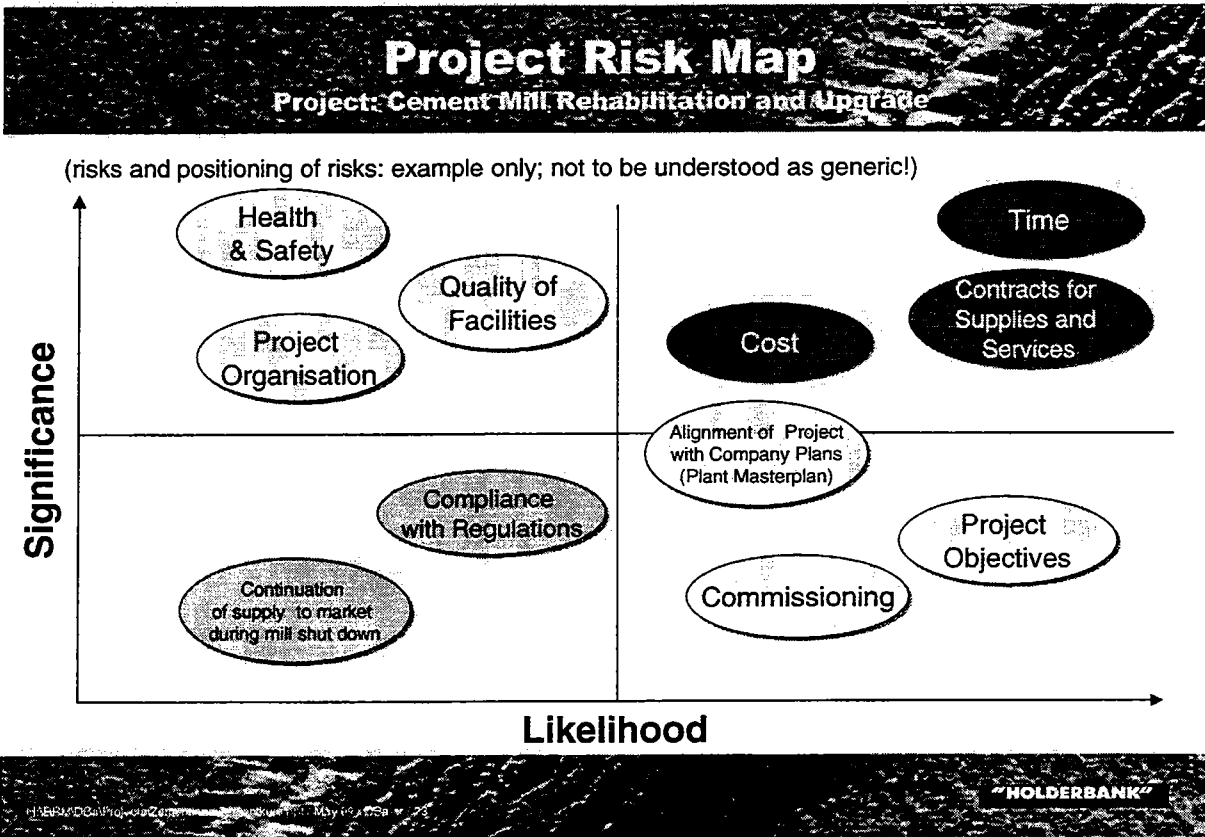
BRMP for Medium and Big Projects

- Basically the same
- Risk profile to be considered in: - **Project concept**
- **Project management**
- ➔ More sophistication in:
 - Risk analysis (→ Risk Maps, Risk Driver Mind-Maps)
 - Quantification (significance in \$)
- Repeated workshops
- Project progress reports to include reporting on risks
- (Tailor-made solutions)

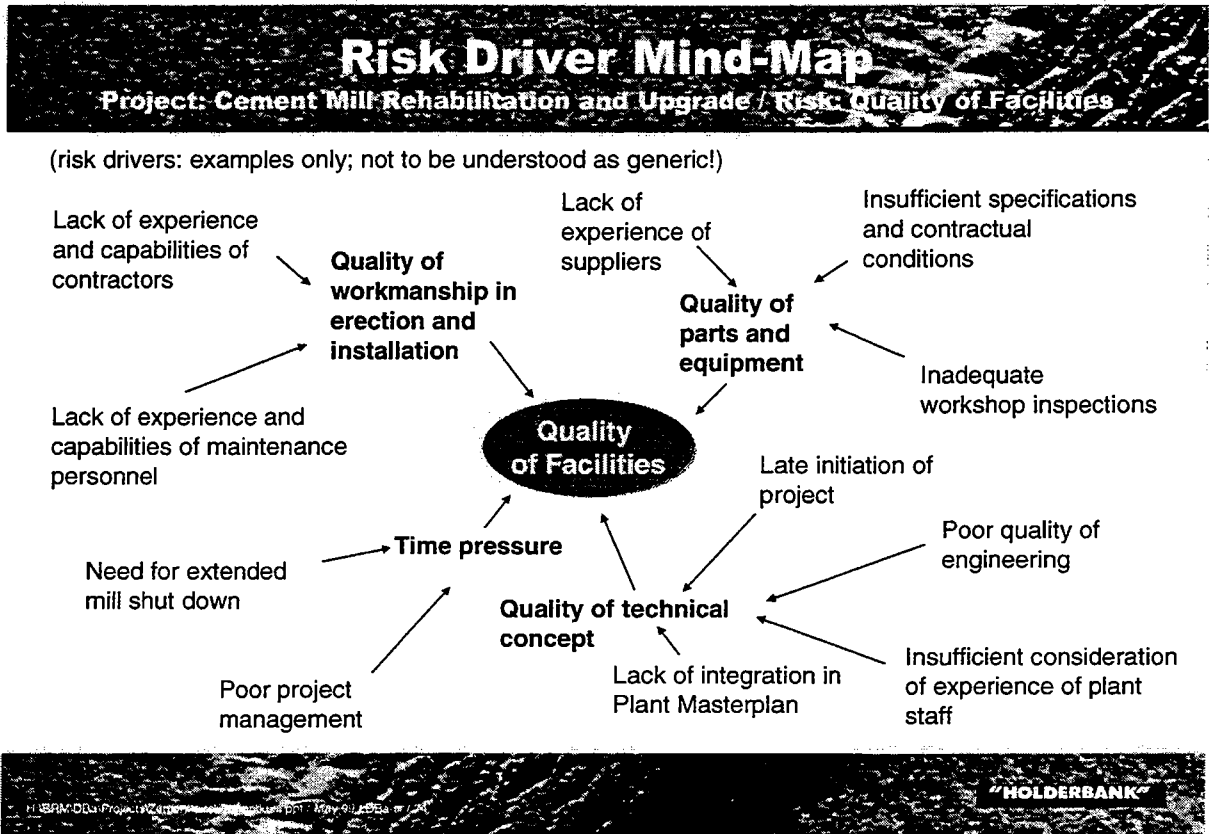
22. SLIDE 22: MEDIUM AND BIG PROJECTS



23. SLIDE 23: PROJECT RISK MAP



24. SLIDE 24: RISK DRIVER MIND-MAP





Business Risk Management for Projects (BRMP)

Checklists and Forms for Small Projects

May 1999
Business Risk Management
"Holderbank" Engineering Switzerland

BUSINESS RISK MANAGEMENT FOR PROJECTS (BRMP) FOR SMALL RPROJECTS

**Project: Kiln Shell Replacement
Risk Identification (examples only)**

Form A1

Generic Risks > Parts of Scope/ Project Stages	Project Parties	Project Organisation	Co-ordination with Production/ Sales	Compliance	Permitting	Contracts for Project Realisation
Pre-shutdown activities			2) Lime stockpile may be too low at the commencement of the shutdown. 4) The shutdown plan and schedule may be inadequate.			9) The composition of the existing kiln material is not known and this will impact on the welding material to be used.
Preparation of used kiln section						
Cutting, removing and shifting of kiln sections				12) Noise may be generated during shutdown activities.		
Replacing, aligning, and welding of kiln shell				11) Significant welding will be required and this may pose a hazard or health risk to personnel. 12) Noise may be generated during shutdown activities.		
Kiln bricking						
Recommissioning, kiln lightup						

BUSINESS RISK MANAGEMENT FOR PROJECTS (BRMP) FOR SMALL PROJECTS

**Project: Kiln Shell Replacement
Risk Identification (examples only)**

Form A2

Generic Risks > Parts of Scope/ Project Stages >	Time	Cost	Quality	Commissioning	Health and Safety	Performance of Contractors
<i>Pre-shutdown activities</i>						
<i>Preparation of used kiln section</i>					5) No formal safety plan by the contractor and no formal transfer of risk.	
<i>Cutting, removing and shifting of kiln sections</i>	1) The contractor's equipment may not arrive in suitable time.				5) No formal safety plan by the contractor and no formal transfer of risk. 6) Some of the work, e.g. debricking, may require work in a confined space. 11) Significant welding will be required and this may pose a hazard or health risk to personnel.	7) The moving piece of the kiln may fall and be damaged.

**Project: Kiln Shell Replacement
Risk Identification (examples only)**

Generic Risks > Parts of Scope/ Project Stages >	Time	Cost	Quality	Commissioning	Health and Safety	Performance of Contractors
Replacing, aligning, and welding of kiln shell	1) The contractor's equipment may not arrive in suitable time.		8) The kiln may not be cleaned prior to welding leading to problems with the weld. 9) The composition of the existing kiln material is not known and this will impact on the welding material to be used. 10) Incorrect alignment of the kiln may occur leading to ongoing operational problems.		5) No formal safety plan by the contractor and no formal transfer of risk.	7) The moving piece of the kiln may fall and be damaged. 10) Incorrect alignment of the kiln may occur leading to ongoing operational problems.
Kiln bricking	3) Late delivery or non-delivery of refractory material.					
Recommissioning, kiln lightup						

**Project: Kiln Shell Replacement
Risk Evaluation and Management (examples only)**

Part of Scope / Project Stage: Pre-shutdown Activities

Risk and Risk Description	Existing Risk Treatment	Risk		Proposed Risk Treatment	Respons. Person	Target Date
		Significance L,M,H	Likelihood L,M,H			
1) The contractor's equipment may not arrive in suitable time.		M	M	Confirm that the equipment has been shipped and will arrive at site prior to the scheduled shutdown commencement time.		
2) Lime stockpile may be too low at the commencement of the shutdown.	Current kiln output is considered to be sufficient to meet this target stockpile by the commencement of the shutdown. A customer survey has been undertaken to gauge expected customer demands during the shutdown period.	M	H	Identify and agree an alternative supply and develop a supply agreement. Continue customer surveys. Ensure that customer silos are filled. Ensure that ISO containers are available and loaded prior to the shutdown. Consult with specialist in this regard. Develop and implement a silo management strategy to ensure that off-specification material in silos at the time of the shutdown is minimized. Schedule production to maximize lime stockpiles at the start of the shutdown.		
3) Late delivery or non-delivery of refractory material.	It is known that the overseas manufactured refractory has been shipped and is currently on route and delivery details confirmed. Local manufacturer representative has been asked to confirm delivery date.	M	L	Do not start the shutdown unless sufficient refractory is available.		

* CONSIDERING EXISTING RISK TREATMENT!

**Project: Kiln Shell Replacement
Risk Evaluation and Management (examples only)**

Risk and Risk Description	Existing Risk Treatment	Risk		Proposed Risk Treatment	Respons. Person	Target Date
		Significance L,M,H	Likelihood L,M,H			
4) The shutdown plan and schedule may be inadequate.	An experienced contractor who has undertaken other kiln shell replacements elsewhere in the vicinity has been engaged. This contractor has contributed to the development of the plan. Owner also has experience with this contractor.	M	L	Ongoing review of the shutdown plan and schedule.		
5) No formal safety plan by the contractor and no formal transfer or risk.	The contractor employs experienced crews and has safely undertaken similar jobs in the past.	M	L	Discuss the option of development of a safety plan and work method statements for key work practices with the contractor. Follow through insurance and workers' compensation situation for the contractor who is a foreigner. Investigate owner's exposure to a major claim if an incident should occur. Confirm whether the kiln interior will be required. Develop a specific procedure for kiln entry during the shutdown.		
6) Some of the work, e.g. debricking, may require work in a confined space.	Site confined space procedure. Site lockout procedure.	M	L	Check if crane support will be used throughout the process. If not, obtain further information from contractor on how the moving piece will be supported. Ensure that clear instructions are given during debricking to ensure kiln is clean enough prior to welding.		
7) The moving piece of the kiln may fall and be damaged.	The strategy for moving the kiln piece has been designed by the contractor to be suitable for movement without failure.	H	M			
8) The kiln may not be cleaned prior to welding leading to problems with the weld.		M	L			

**Project: Kiln Shell Replacement
Risk Evaluation and Management (examples only)**

Risk and Risk Description	Existing Risk Treatment	Risk Relevance*		Proposed Risk Treatment	Respons. Person	Target Date
		Significance L,M,H	Likelihood L,M,H			
9) The composition of the existing kiln material is not known and this will impact on the welding material to be used.	All likely materials required to be used in welding are known to be available.	M	L	Undertake sampling and analysis as soon as possible once the kiln material is available for sampling.		
10) Incorrect alignment of the kiln may occur leading to ongoing operational problems.	The contractor is expert in undertaking kiln shell replacements. Owner's personnel will confirm alignment prior to commencement of welding (included in work schedule). Contractor expertise and existing welding procedures.	H	L	No additional risk treatments are recommended.		
11) Significant welding will be required and this may pose a hazard or health risk to personnel.	Contractor expertise and existing welding procedures.	L	L	Ensure that contractors are briefed regarding owner's requirements in relation to welding. Ensure that ID fan is used to ventilate the interior of the kiln.		
12) Noise may be generated during shutdown activities.	There is a restriction of night time operations at site. Owner's personnel is well aware of noise issues and takes control action to reduce noise. A complaint procedure is in place for dealing with environmental complaints, e.g. noise complaint.	L	L	No additional risk treatments are recommended.		

BUSINESS RISK MANAGEMENT FOR PROJECTS (BRMP) FOR SMALL RPROJECTS

**Project:
Risk Identification** **Form A1**

Generic Risks > Parts of Scope/ Project Stages >	Project Parties	Project Organisation	Co-ordination with Production/ Sales	Compliance	Permitting	Contracts for Project Realisation

BUSINESS RISK MANAGEMENT FOR PROJECTS (BRMP) FOR SMALL PROJECTS

Project:
Risk Identification **Form A2**

Generic Risks > Parts of Scope/ Project Stages >	Time	Cost	Quality	Commissioning	Health and Safety	Performance of Contractors

BUSINESS RISK MANAGEMENT FOR PROJECTS (BRMP) FOR SMALL PROJECTS

Project: Form B
Risk Evaluation and Management

Part of Scope / Project Stage:

Risk and Risk Description	Existing Risk Treatment	Risk Relevance* Significance L,M,H	Risk Likelihood L,M,H	Proposed Risk Treatment	Respons. Person	Target Date
1) ...						
2) ...						
3) ..						
4) ...						
5) ...						

* CONSIDERING EXISTING RISK TREATMENT! L, M, H = LOW, MEDIUM, HIGH